Predictors of stroke outcome

Dissertation

Submitted to

Tamil Nadu Dr MGR Medical University

in partial fulfillment of

Rules and regulations for

MD Branch XIX Physical Medicine and Rehabilitation

Of The Tamilnadu Dr.M.G.R. Medical University

Acknowledgements

I am grateful to the Vice Chancellor Dr Mayilvahanan Natrajan and the Almighty for having given me this golden opportunity.

I would like to thank Prof G. Arjundas – Distinguished Professor in Neurology (TN MGR Med Univ) for his expert guidance and constant encouragement.

I would like to thank Dr. Deepak Arjundas, Head of the Stroke Unit and Department of Neurology –Vijaya health Centre for his valuable suggestions.

I would like to acknowledge the Ethics Committee of Vijaya Health Centre for permitting us to conduct the study.

I am grateful to Mr Srinivasan and Miss Sweety David, both therapists who helped me in data collection, documentation and follow up.

I am thankful to the patients and their families who participated in this study and shared their personal information.

I am deeply grateful to my family for their system support and encouragement during this study.

.

Table of contents

ACKNOWLEDGEMENTS	**2**
INTRODUCTION	**4**
OBJECTIVE	**5**
REVIEW OF LITERATURE	**6**
RISK FACTORS	**8**
MATERIALS AND METHODS	**16**
OBSERVATIONS AND RESULTS	**19**
CONCLUSION	**39**
BIBLIOGRAPHY	**40**

Introduction

Stroke is a multi-factorial disease where combinations of risk factors, gradually influence the subject's likelihood of suffering a stroke. It is the second leading cause of death[1] and one of the commonest causes of disability in adults. In 2005 stroke accounted for 5.7 million deaths worldwide which is equivalent to 9.9% of all deaths. Two-thirds of those deaths will have occurred in people living in developing countries[2]. While India is still struggling with the problems of communicable diseases, noncommunicable diseases are on the rise. Stroke is potentially the most devastating consequence of vascular disease, causing serious long-term disability and incurring extremely high medical, emotional and financial costs. Hypertension is the number one risk factor for stroke. Control of hypertension can decrease the morbidity and mortality due to stroke. Age is an important and independent risk factor for stroke (Wolf et al 1992).[3] 20-30% of the hospital stroke population falls below the age of 40 years (Nagaraja and Taly 1988).[4]

Objective

The objective of the study was to evaluate the co –relation between the type of stroke, severity of stroke, risk factors leading to stroke, admission delay and stroke outcome. The stroke outcome was evaluated four weeks after onset using the NIH scale and Modified Rankin Scale.

Review of literature

Stroke has been defined as a sudden neurological deficit characterized by loss of motor control, altered sensation, cognitive or language impairment and disequilibrium or coma caused by nontraumatic brain injury resulting from occlusion or rupture of cerebral blood vessels.

Strokes are grossly categorized into ischemic and hemorrhagic. 85% of strokes are ischemic causing cerebral infarction. Of these ischemic strokes 40% are large vessel 20% are small vessel and 20% are thromboembolic and 5% are vasculitis and other rare causes.

Hemorrhagic strokes constitute the other 15%. They are further sub divided into intra cerebral hemorrhages (10%) and sub-arachnoid hemorrhages (5%).The etiology of the stroke can be inferred by classifying the temporal profile of the stroke from the patient's history and clinical examination. TIA transient ischemic attack is an event when the neurological symptoms develop and disappear within 24 hours. RIND Reversible ischemic neurological deficit lasts longer than 24 hours. It is thought to be due to lacunar infarctions of the sub cortical gray and white matter. Embolic strokes occur within minutes while hemorrhagic strokes often evolve over 1-2 hours and ischemic strokes have a rapid or prolonged onset.

Cerebral ischaemia causes not only reversible and then irreversible loss of brain function, but also cerebral oedema Ischaemic oedema it partly

'cytotoxic' and partly 'vasogenic'. Cytotoxic oedema starts within minutes of stroke onset, and affects the grey more than the white matter, with damaged cell membranes allowing intracellular fluid to accumulate and apoptosis (Cell Death).

Risk factors

Non –modifiable

Age

Gender

Race

Previous history of stroke

Modifiable

- Hypertension
- Diabetes
- Atherosclerosis
- Atrial fibrillation
- Nicotine
- Sedentary lifestyle
- Oral contraceptives
- Metabolic syndrome
- Hypercoagulable states
- Hyperhomocysteinemia

Hypertension

Hypertension is a definite predisposing factor for the development of a cerebrovascular accident. Hypertension causes endothelial injury, increases endothelial permeability to lipoprotein and the hemodynamic stress may precipitate plaque rupture. Macmohan et al found that 7.5mm of Hg reduction of diastolic blood pressure was associated with 46% reduction in stroke risk in hypertensive and subjects[5] In the MRFIT (Multiple risk factor interventional trial) study[6] increased mortality were associated with systolic BP more than 160mmHg and diastolic BP more than 95mmHg. The Systolic Hypertension in the Elderly program (SHEP)[7] randomized 4700 subjects over 60 yrs of age with systolic pressures of more than 160 mmHg and diastolic pressure more than 90 mm Hg to antihypertensive treatment and placebo. Over a period of five years subjects treated with anti-hypertensive medication had an average reduction of systolic blood pressure measuring 17 mmHg and 36% reduction in incidence of stroke compared to the control subjects.

Diabetes

Bell[8] has reviewed the literature describing the relationship between diabetes and stroke. Most ischemic strokes in diabetic patients are due to occlusion of small paramedial penetrating arteries. The occlusions cause small infarcts within the white matter of the brain. Diabetic autonomic neuropathy may contribute to the development of cerebrovascular disease in diabetics. The Diabetes Control and complication trial[9] a prospective longitudinal study proved that intensive control of diabetic status reduced neurological complications by 60%.

Nicotine

Smoking is an important independent risk factor confirmed by the Framingham study. The relative risk of stroke for heavy smoker is twice that of light smokers. Cessation of smoking reverses risk to that of non-smokers within 15 years of quitting.

Dyslipidemia

The role of elevated cholesterol per se has not proved to increase stroke incidence, but along with development of atherosclerosis and coronary artery disease it has proven to be an indirect risk factor. There has been a strong relation between carotid artery atherosclerosis and increased serum cholesterol levels.[10,11]

Clinical features

1. Sudden numbness or weakness of the face, arm or leg especially on one side of the body.
2. Sudden confusion, difficulty in talking or understanding speech
3. Sudden difficulty in seeing in one or both eyes.
4. Sudden difficulty in walking, dizziness or loss of balance or coordination.
5. Sudden severe headache with no known cause.

INVESTIGATIONS:

Once a stroke is suspected clinically a brain imaging study is necessary to determine if the etiology of stroke. Is it ischemic or hemorrhagic? Computed tomography [CT] imaging of the brain is the standard imaging modality to detect the presence or absence of intracranial hemorrhage. Early CT scanning of brain will not pick up the infarct but helps to exclude hemorrhage. Infarct may not be seen reliably for 24-48 hours in CT brain.

MRI reliably documents the extent and location of infarction in all areas of brain, including the posterior fossa and cortical surface. MRI is less sensitive than CT for

detecting acute bleed. Diffusion weighted imaging is more sensitive for early brain infarction than standard MR sequences, as is FLAIR [Fluid Attenuated Inversion Recovery] imaging.

Other investigations to be done are

Chest X ray

ECG,

Echocardiography. TEE

Urine analysis,

Complete blood count,

Serum electrolytes,

Blood urea nitrogen,

Creatinine,

Blood sugar,

Serologic tests for AIDS, syphilis,

Lipid profile

Carotid Doppler

M R Angiogram of neck vessels

Treatment

The therapeutic goal of current stroke treatment is to stop neurological deterioration, limit neurological impairment and minimalize the functional disability. When the patient is medically stable rehabilitation is begun.

Medical management

Primary prevention

The inexpensive aspirin is the first choice in a dose of 50-365mg/day[12]

Secondary prevention

Clopidogrel 75mg is the other anti-platelet agent used alone or in combination with aspirin.

Statin therapy as per the SPARCIL trial[13] atorvastatin upto 80mg recommended statins to prevent recurrent strokes

Thrombolysis

Surgical management

Carotid Endarterectomy, clot removal, surgical decompression

Rehabilitaion

Rehabilitation is started once the patient is neurologically stable.

Multi-disciplinary approach with Physiatrists, physical therapists, occupational therapists and speech therapists clinical psychologists,orthotist improve the stroke

outcome by 60%. Periodic assessment and care-giver counseling minimizes post-stroke complications.

Commonest complications are depression, respiratory infections, aspiration pneumonia, deep vein thrombosis, shoulder dysfunction, spasticity, falls and injuries, bladder and bowel dysfunction. These set-backs hamper stroke recovery and the patient and the family have loss of motivation – thus leading to an unfavourable stroke outcome.

Materials and Methods

The format of the study was the WHO STEP wise stroke surveillance study and ICASS -2 study .This ICASS-II /WHO STEP wise stroke surveillance study is a sequel to the ICASS - I study conducted in 2002. ICASS is the acronym for Indian Co-operative Acute Stroke Study done by the Indian Stroke Association. This is a prospective study conducted in 2 private hospitals under Prof .G. Arjundas (Prof. Emeritus TN MGR medical university). A total of 402 patients were evaluated at Vijaya Health Centre and Mercury Nursing Home in Chennai, India. WHO defines stroke as "a focal (or at times global) neurological impairment of sudden onset, and lasting more than 24 hours (or leading to death) and of presumed vascular origin".[14] The strokes were confirmed by CT scans or MRI magnetic resonance imaging. The study duration was from Dec 2003- Dec2004. A pilot study of 10 cases was evaluated before the actual study started in Dec.03. The WHO stroke surveillance part of the study focuses on hospitalized stroke patients only (STEP- 1).The data collection was by "hot pursuit". Hot pursuit signifies active ongoing recruitment of stroke patients and not a retrospective (cold pursuit) collection of cases. We did not undertake the evaluation of strokes in the community (STEP -2 and STEP-3) due to our inability to conduct door to door surveys.

The epidemiological data of age, gender, occupation, socio-economic status, race and religion were also obtained for the surveillance study. Inclusion criteria of stroke patients are the following. Those with sudden neurological deficit lasting 24 hours,

those with new neurological deficit in a different arterial territory within 28 days, those with new neurological deficit in the same arterial territory after 29 days were considered as a new stroke case. Those with new neurological deficit in the same arterial territory within 28 days were not considered as new stroke cases[15.]

The type and sub-type of strokes were established and analyzed. The severity of strokes was evaluated by international scales such as the modified NIH(National Institute of Health) scale and the outcome by the Modified Rankin Scale (MRS).[16] The NIH scale was evaluated on the day of admission and on the third day of admission. The highest NIH score was taken as the indicator of the severity of the stroke. The MRS was evaluated after 4 weeks by physical evaluation or by telephonic interview of the attendant. In this study 4 week follow up was possible in 354 of the 402 patients. This was because some patients come from remote rural areas where communication links are inadequate and also due to illiteracy, the contact addresses were inadequate. The scoring of the Modified Rankin Scale is <3 where the patient is walking independently and requires no assistance for his/her activities of daily living (ADL). MRS score of 3-4 is where mobility assistance is required and 5 is where the patient is totally dependent for his ADL and MRS score of 6 is used to document the mortality.

The risk factors of age, hypertension, diabetes mellitus, ischemic heart disease, dyslipidemia, anemia and nicotine intake were evaluated.

Risk factor inclusion criteria are as follows. Hypertension is diagnosed if BP is >140/90 on 2 independent readings or on anti-hypertensive treatment. Diabetes mellitus is defined if 2 independent reading of blood glucose is >180mg/dl (post-

prandial – venous sample) or an elevated glycosylated hemoglobin or on anti-diabetic treatment. Hyperlipidemia is defined if the total cholesterol was above 200mg/dl or LDL is more than 160mg/dl or triglycerides more than 150 mg/dl or VLDL is >26mg/dl.

The statistical analysis used p-value and odds ratio using multiple logistic regression (forward stepwise addition method) to infer the statistical significance of the various risk factors. Pearson correlation analysis was also done to look for linear association between single and combination of risk factors.

Observations and results

Age

77.8% of our patients were between 50 and 79 years of age. The youngest patient was 17 years old and our oldest patient was 92 years. The morbidity with severe disability and death is greatest in the 6th to 8th decades as revealed by MRS Scores of 5 and 6. The p-value is 0.04 which is statistically significant.

The mean age of stroke is 61.7. The standard deviation is 13.4.

Table 1 Patients Age vs MRS Score

Age	*Modified Rankin Scale Score*				*p-value*
	<3	**3-4**	**5**	**6**	
<29	5	2	0	2	0.04 (sig)
30-39	8	3	1	2	
40-49	17	2	1	1	
50-59	44	15	7	11	$\chi^2 = 34.09$
60-69	55	31	26	12	
70-79	38	14	12	14	d.f. = 21
80-89	12	4	4	8	
90>	0	0	1	2	
Total	179	71	52	52	

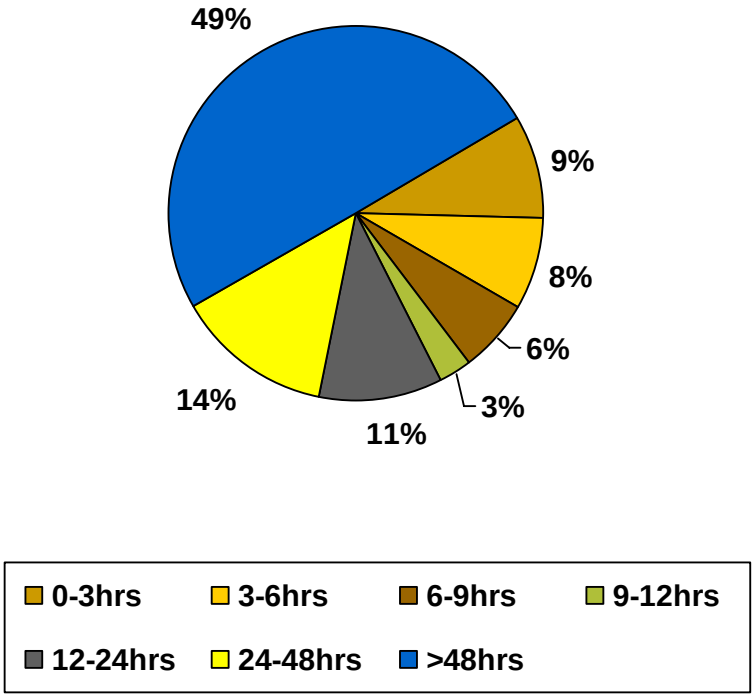
Gender

We had 265 (65.9%) male patients and 137 (34.1%) female patients. The stroke outcome was evaluated in 354 patients and there was no statistical significance in relation to gender of the patient and stroke outcome.

Table 2 Gender vs MRS Score

Gender	*Modified Rankin Scale Score*				*p-value*
	<3	**3-4**	**5**	**6**	
Male	119	44	32	37	0..67 (not sig)
Female	60	27	20	15	$\chi^{2} = 1.56$
Total	179	71	52	52	d.f. = 3

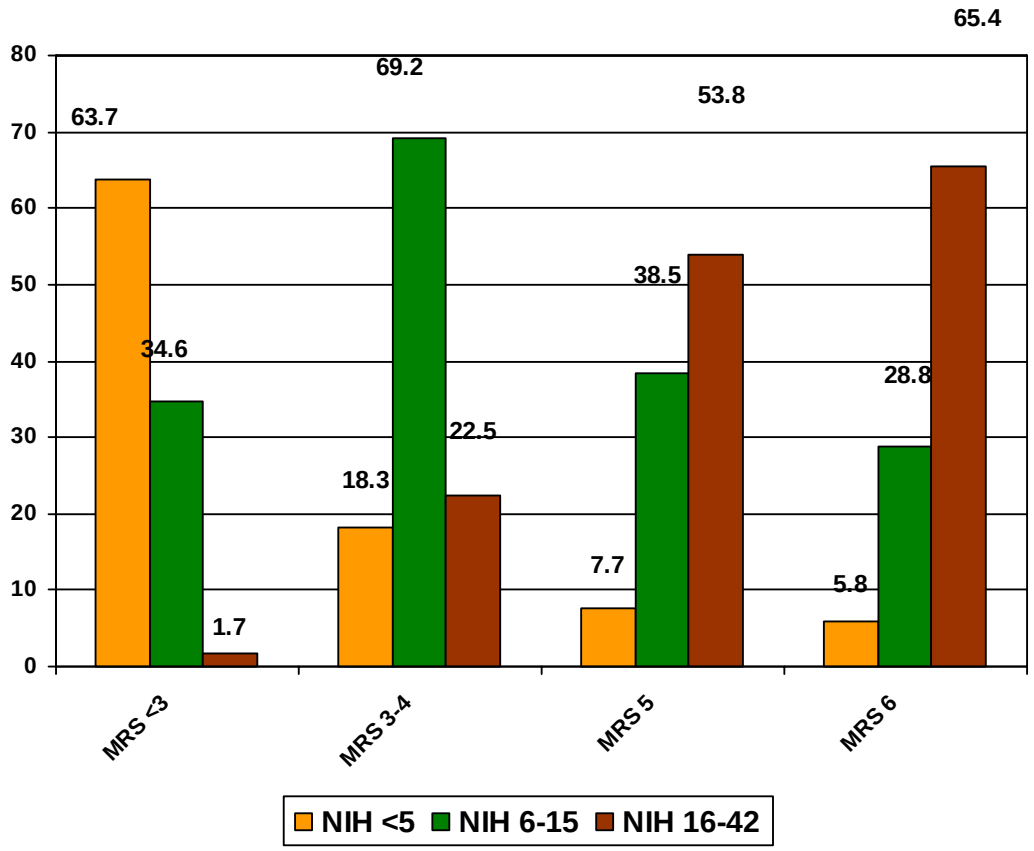
Admission delay



Admission delay refers to the time window between the onset of symptoms of stroke and the onset of treatment. 49% of the patients reported to our hospital after 48 hours of onset of symptoms. The patients were taken to tertiary level centers after initial care in smaller nursing homes in neighboring towns and villages. Or there was a delay in identifying the stroke warning symptoms. Only 9% reached the hospital within 3 hours.

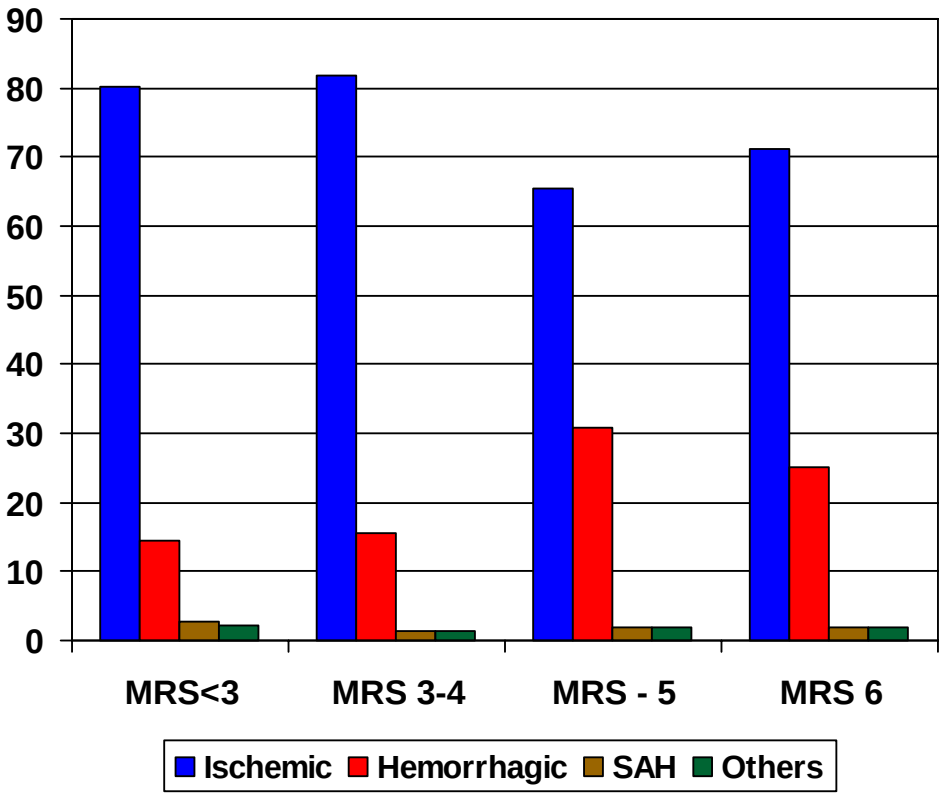
Severity of stroke

The NIH (National Institute of Health) score is used to measure the severity of stroke. It was assessed on admission, the third day of illness and seventh day of illness. The score ranges from 0 – 42. The NIH score can be assessed within ten minutes and it has a high specificity. A score of NIH less than 5 (mild) had 64% independent stroke survivors. A score of 16 – 42 showed a morbidity of 38.5 percent and a mortality of 53.8%.



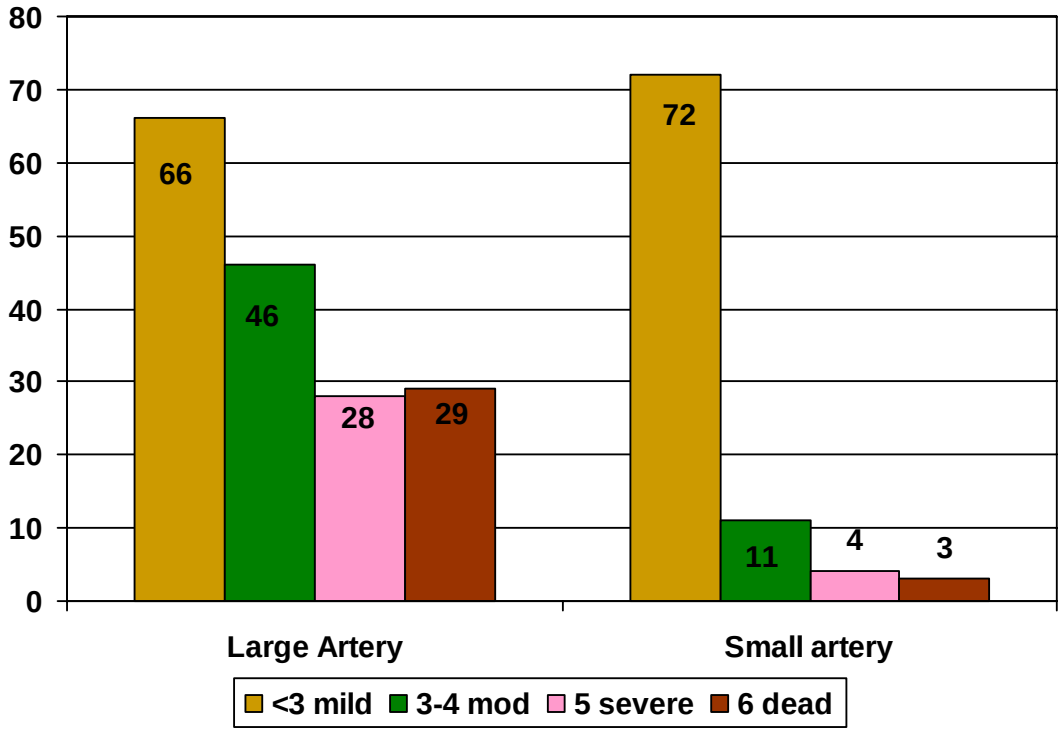
Type of stroke vs outcome

In our study 77% of our strokes were ischemic and 17% were hemorrhagic strokes. Of these ischemic strokes 80% had a MRS less than 3 and 71% had MRS score of 6. However hemorrhagic strokes showed 30% and 25% MRS of 5 and 6. On statistical analysis there is a trend showing a likely increase in morbidity and mortality with hemorrhagic stroke. The p-value was 0.38 which is statistically insignificant. A larger case study would be required to confirm the statistical significance of the trend.



Size of infarct versus stroke outcome

The TOAST classification (Trial of Org 10172 in Acute stroke treatment) of sub-types of ischemic stroke was used. Large Artery atherosclerosis was when the infarct size was greater than 1.5cms in diameter on CT or MRI. Lacunar infarcts or small artery occlusion was when the infarct size was less than 1.5cms. Cardioembolic strokes, strokes of other determined etiology and undetermined etiology are the other three in this classification. As the majority of strokes belonged to large artery and small artery type we evaluated the stroke outcome in these categories. In the large artery type we had 66 patients with an MRS score of less than 3 and 72 patients with lacunar infarcts with a similar MRS score. The mortality was 29 in the former and 2 in the latter. On statistical analysis the p-value was <0.0001 which is statistically significant.



Modifiable Risk Factors

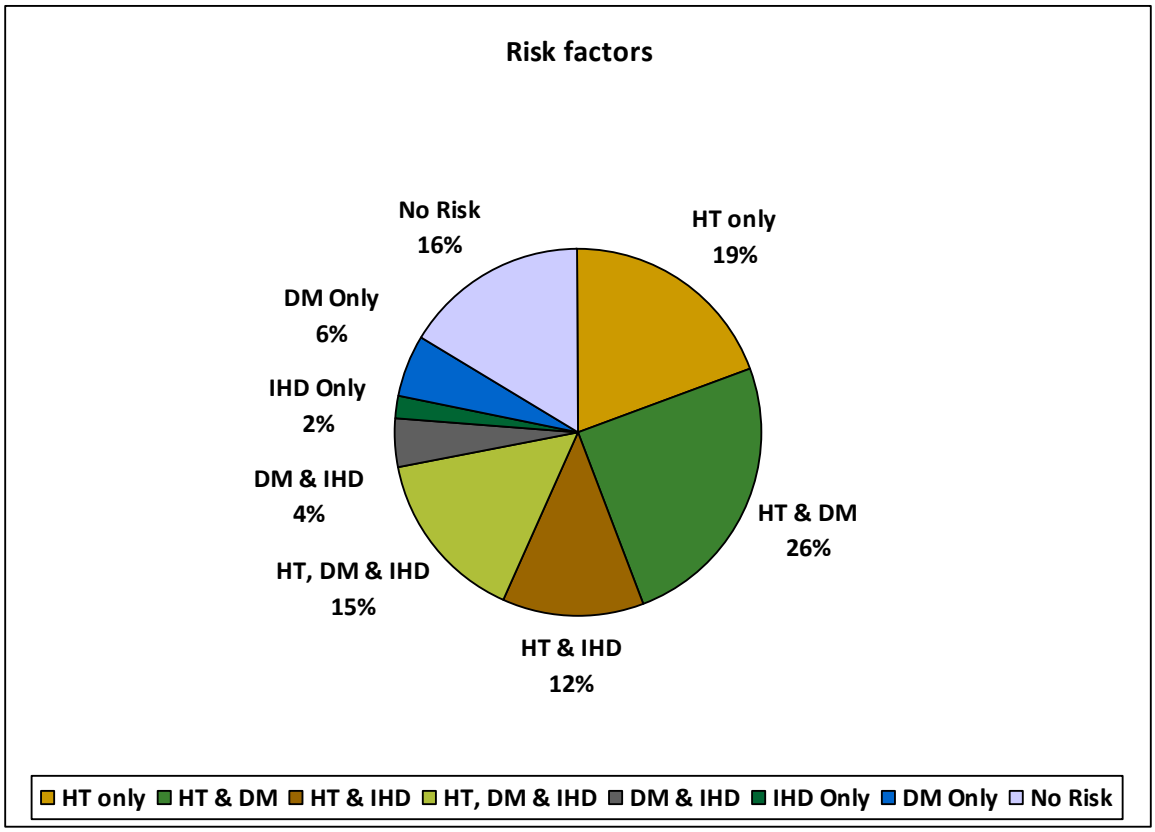
Hypertension was found to be a major risk factor of stroke in 72 percent of the patients. It was found to be associated with stroke alone and in combination with diabetes mellitus and IHD. 49.8% had diabetes mellitus and 33.8% had ischemic heart disease. Around 16% of the patients in this study had no significant risk factor detected with the present facilities and methods available.

Table 3 Incidence of Modifiable Risk Factors

Risk Factor	*No of cases*	*Percentage*
Hypertension	289	71.9%
Diabetes mellitus	200	49.8%
Ischemic heart disease	136	33.8%
Atrial fibrillation	13	3.2%
Valvular heart disease	14	3.5%
Congenital heart disease	2	0.5%
Total Cholesterol	105	26.1%
HDL Low	159	39.6%
LDL High	30	7.5%
TGL High	117	29.1%
VLDL High	155	38.6%
Nicotine	95	23.6%
Anemia	40	10.0%

Hypertension

289 patients (72%) of the 402 were hypertensives. The 4 week follow up by modified Rankin scale was possible in 354 patients. Out of this 260 were diagnosed as stroke with hypertension as risk factor (HT alone or in combination with other risk factors). 140/90 mm Hg and above was taken as hypertensive. 129 of them had a MRS score of 0-2 (mild disability), 57 had a MRS score of 3-4 (moderate disability) and 41 had a MRS score of 5 (severe disability) and 33 patients died. The p – value is 0.15 which is not statistically significant. Chi square = 5.31, d.f. =3.



Diabetes

200 (49.8%) patients were diabetic. Among these patients a 28 day follow up was possible in 173 patients. Blood sugar (post prandial venous sample) >180 mg/dl were taken as diabetes. 76 patients had an MRS score of 0-2 (mildly disabled) while 37 patients had MRS score of 3-4 (moderate disability) and 27 patients had MRS score of 5 (severe disability) and 33 expired. The p-value is 0.049, chi -square 7.87 and d.f = 3 and is statistically significant.

Ischemic heart disease

136 patients (33.8%) were found to have IHD. 126 of these patients were followed up at 28 days. These were diagnosed by the electrocardiogram and ECHO findings and confirmed by a cardiologist. 53 patients had MRS scores of 0-2 (mild disability) while 27 of them had MRS score of 3-4 (moderate disability) and 23 patients had MRS scores of 5 (severe morbidity). 23 patients expired. The p-value is 0.10 and chi square = 6.37.

Dyslipidemia

The individual components of the lipid profile (such as total cholesterol, HDL, LDL, VLDL and TGL) were evaluated. Total cholesterol was evaluated in 271 patients of whom 176 had hypercholesterolemia and 95 had normal cholesterol values. 96 had a MRS score of <3 MRS of 3-4 and 24 had a score of 5 and 12 had a score of 6. P-value = 0.21 which is statistically insignificant when compared with those who had normal values.

LDL and stroke outcome was evaluated in 242 patients. 137 had an MRS score of <3 49 had a score of 3-4 and 27 had a score of 5 and 29 had a score of 6. The p-value is 0.43 which is insignificant.

The Triglyceride levels and stroke outcome were analyzed in 163 patients. 87 had MRS scores of <3. 33 had MRS score of 3-4 and 21 had a score of MRS 5 and 22 had a score of MRS 6. The p-value is 0.26 which is insignificant.

The VLDL levels and stroke outcome were analyzed in 127 patients. 71 had a MRS score of<3, 23 had a MRS score of 3-4 and 19 had a MRS score of 5 and 14 had a score of 6. The p-value is 0.42 which is not statistically significant.

Tobacco

23.6 percent of the stroke patients consumed tobacco –either via smoking cigarettes or beedis, or chewing tobacco with betel leaves or nasal snuff. 10% of the patients were found to be anemic. 48 patients had a MRS score of <3 16 had a score of 3-4 and 8 had MRS scores of 5 and 8 had MRS scores of 6. The p-value is 0.42 which is statistically insignificant.

Table 4 Modifiable Risk Factors vs Stroke Outcome

Risk factor	*Modified Rankin Scale Score*				*p-value*
	<3	**3-4**	**5**	**6**	
Hypertension	129	57	41	33	0.15
Diabetes mellitus	76	37	27	33	0.049
IHD	53	27	23	23	0.37
Total cholesterol	96	37	24	19	0.21
LDL	137	49	27	29	0.43
TGL	87	33	21	22	0.26
VLDL	71	23	19	14	0.15
Nicotine	48	16	8	8	0.42

On evaluating a combination of risk factors diabetes and hypertension - the number of patients with 5 & 6 on the MRS showed severe morbidity and mortality than those with minimal disability <3.

Table 5 Modifiable risk factors - Alone and in Combination

Risk factor	*Modified Rankin Scale Score*				*total*
	<3	**3-4**	**5**	**6**	
Hypertension	42	14	10	4	70
Diabetes mellitus	10	1	1	4	16
Ischemic	4	2	0	2	8
HT +DM	42	20	12	13	87
HT+IHD	25	9	9	5	48
DM+IHD	4	2	4	5	15
HT + DM +	20	14	10	11	55
No risk	32	9	6	8	55

P=0.003 (significant)

Chi-square trend 8.81

d.f =1

There were only 8 stroke patients with IHD alone as the risk factor and only 15 patients with Diabetes and Ischemic heart disease (out of 354) as the risk factors. This figure is too small to be statistically significant. However though there is an association of DM and IHD in the multi –factorial etiology of stroke these risk factors independently do not add any additional risk to the stroke outcome.

When three or more risk factors are involved the mortality (MRS) rises to one-fifth.

Table 6 Regression Analysis Results

Independent	***Reg. coefficient***	***S.E (6)***	***p-value***	***Odds ratio***
Age	0.31	0.16	0.045	1.37
Diabetes mellitus	0.71	0.31	0.02	2.02
IHD	0.69	0.31	0.03	1.98

The results of multiple logistic regression analysis shows, an increase in morbidity and mortality with the MRS scores more than 5 in the above risk factors of age, diabetes mellitus and ischemic heart disease. The non-significant variables are sex, hypertension and LDL (dyslipidemias). Hypertension is the most significant risk factor however the stroke outcome is not affected as there are proportionate numbers of hypertensives with favourable outcome too. However hypertension increased morbidity and mortality.

Discussion

JD Pandian et al did a study on public awareness of stroke symptoms and risk factors and treatment at CMC Ludhiana, Punjab India in 2005.They found that of 942 individuals stroke awareness was not there in 45% of subjects. 23% did not know a single symptom of stroke. 21% did not know a single risk factor of stroke. The results concur with the data of admission delay in our study where 49% reported for admission after 48 hours. The earlier the stroke warning symptoms and signs are recognized the lesser the neuronal damage and the better the stroke outcome[17.] According to Jeffrey L Saver , every minute in which a large vessel ischemic stroke is not treated, the average patient loses 1.9 million neurons, 13.8 billion synapses, and 12 km (7 miles) of axonal fibers. Each hour, in which treatment is delayed, the brain loses as many neurons as it does in almost 3.6 years of normal aging. The newer treatments of tissue plasminogen activator (tPA) can reverse neurological deficit if the patient can reach a stroke unit within 3 hours of onset of symptoms.

In our study the age group of maximum stroke incidence was 50-79 years with a mean age incidence of 61.7 +_ 13.4 (SD). In the German Stroke Data Bank study by Armin J Grau et al[18] the age incidence was 65.9+_ 14.1. The above mentioned study also used the Modified Rankin scale to follow up the patients. Stephen Bagg[19] from Ontario, Canada has reported that age in combination with severity of stroke has to be considered while predicting the impact on functional outcome. The outcome of stroke depending on the sub-type was similar to ours. A study done in Karachi Vohra EA[20]

also shows similar results of increased mortality and morbidity due to advancing age and cardiac illness. Majority of their cases were between 4th and 6th decade. They had 50% hypertensives, 19% CAD and 18% diabetes and 17% were smokers.

Gender differences are present in the incidence of stroke in our study. 65.9% were men and 34.1% were women. However this could reflect the gender bias existing in Indian society. There is no statistically significant difference in the stroke outcome due to gender.

A Malaysian study by Ong et al[21] reported in 2002 concluded that hypertension and diabetes are the commonest risk factors of stroke admitted in a tertiary hospital in Malaysia. Their incidence of hypertension was 71.5% and diabetes was 40.2% which was similar to ours. They had a mortality rate at one month of 20.3% while we had a mortality rate of 14%. In this study they used the Glasgow Coma Scale to assess the severity of stroke. We found the NIH scale more specific.

In our study elevated total cholesterol, LDL, VLDL, TGL and lower HDL values have not directly contributed to the incidence of ischemic or hemorrhagic stroke. Similar finding have been observed by Ross et al.[22] Ross R found that elevated serum cholesterol has not been linked to an increased stroke incidence. However it indirectly increases stroke risk due to hypercholesterolemia and coronary artery

disease. Two large meta-analyses [23, 24] aggregated from very large cohorts failed to find a relationship between cholesterol and stroke. However the MRFIT study[25] in 350,977 men aged 35-57 years found that a clear relationship emerged when stroke was categorized into ischemic and hemorrhagic types. The risk of ischemic stroke rose with increased cholesterol, and hemorrhagic stroke rising with lowest cholesterol values.

Another large 10-year prospective study in Britain by Wannamethee SG (Stroke 2000),[26] of 14,175 middle-aged men and women, free of clinical cardiovascular disease at the outset, found a weak inconsistent relationship between low density lipoprotein-cholesterol (LDL-c) or high density lipoprotein-cholesterol (HDL-c) and ischemic stroke. In the WHO 2004 study by Ezzah M, Lopez AD et al found a definite global and regional burden due to raised total cholesterol level leading to 4.4 million deaths annually.

Samy I.Mcfarlane[27] et al have concluded that the lowering of blood pressure to <130/80 mm of Hg is strongly recommended for the primary and secondary prevention of stroke. Lowering LDL<100mg/dl in diabetics without prior stroke and <70mg/dl in diabetics with stroke is currently recommended.

23.6% of our patients used nicotine in the form of chewing tobacco, nasal snuff, cigarettes and beedis. Our figures show increased mortality and morbidity in nicotine consumers compared to those who do not. (p= 0.009 statistically significant) Smokers both current and past have a higher risk of developing stroke was earlier quoted by Ruth Bonita et al 1986.[28]

Lefkovits J, of Royal Melbourne Hospital Australia,[29] found that age, cardiac disease and diabetes all independently worsen acute stroke outcome – this is similar to our Indian findings.

The Framingham Heart study identified hypertension, diabetes mellitus, hyperlipidemia and smoking as the major atherogenic factors for stroke[30]. In rural Japan a low serum cholesterol was associated with increased risk of cerebral hemorrhage[31].An Indian study by Dalal et al in Mumbai showed significant association of heart disease, hypertension and smoking and stroke[32]. The findings were similar to the data analyzed in our study.

Katedry i Kliniki Neurologii AM w Lublinie Szczepanska-Szerej A et al[33] found in a Polish study in 2003 that diabetes has no effect on the course and outcome of ischemic stroke. In contrast we found that in our Indian subcontinent Diabetes is an independent risk actor by itself in increasing the morbidity. A Spanish study by Arboix

et al[34] of 393 diabetics with stroke found that they had a different clinical pattern of ischemic stroke with atherothrombotic stroke and lacunar infarcts being more frequent. It also affected the in-hospital mortality.

In our study 16% of our stroke patients had no known risk factors (cryptogenic). Catalina & Adnan Qureshi et al[35] have found upto 30% of strokes can remain cryptogenic after excluding the identifiable risk factors including septal defects. Unidentified environmental and genetic factors may play a role.

Appelros et al[36] studied stroke outcome after one year, while we studied outcome at one month. He found that along with age and stroke severity, dementia also played an important role in morbidity, recurrence of stroke and mortality.

Johnston et al[37] found a multivariable relationship between clinical variables and imaging as predictors of stroke outcome at 3 months.

Conclusion

Prediction of the outcome of stroke essentially depends on the age, admission delay, sub-type of ischemic stroke and the severity of stroke. The NIH score on the third day and seventh day of illness proved to be an essential tool in evaluating the severity of the stroke. The morbidity and mortality of stroke as determined by the outcome at 4 weeks by the modified Rankin scale, is significant in patients with a combination of risk factors such as diabetes and ischemic heart disease and nicotine. The gender of the individual did not alter the outcome. Though hypertension increased the incidence of stroke, hypertension and dyslipidemia did not alter the stroke outcome directly in this study. Prediction of stroke outcome enabled the patient, the care-giver and the family to prepare for mild, moderate or severe disability.

Bibliography

1 Murray CJL and Lopez AD. Mortality by cause for eight regions of the world; Global burden of Disease Study: Lancet 349, 1269-1276.1997.

2 World Health Organization. The World Health Report; 2002 Reducing risks: promoting healthy life.2002.World Health Organization.

3 Wolf PA, CobbJL.,Agostino RB: Epidemiology of stroke in Stroke. Pathophysiology, diagnosis and management. New York,3-27.1992.

4 Nagaraja D Taly AB: Stroke in the young Sinha KK(ed) Progress in Clinical Neurosciences,2.129-145. 1988.

5 Macmohan S, Peto R et al. Blood pressure, stroke and coronary heart disease. Lancet 1990;335:765-774

6 Iso H, Jacobs DR, Wentworth D, Neaton JD, Cohen JDfor the MRFIT Research Group . Serum cholesterol levels and six year mortality from stroke in 350,977 men screened for the Multiple Risk Factor Intervention Trial. N Engl J Med 1989; 320: 904-910.

7Perry HM Jr et al .Effect of treating isolated systolic hypertension on the risk of developing various types and subtypes of stroke: the Systolic Hypertension in the Elderly Program SHEP JAMA. 2000 Jul 26;284(4):465-71.

8 Bell DSH: Stroke in the diabetic patient. Diabetes Care 17:213-19, 1994

9 DCCT Research Group. Diabetes Control and Complications Trial (DCCT): update. Diabetes Care 1990;13:427-433

10 Ross R. The Pathogenesis of atherosclerosis.An update. N EnglJ Med 1988:20:488-500

11 The Expert Panel. Report of the National Cholesterol Education Program Expert Panel on Detection of High blood Cholesterol in Adults. Arch int Med 1998;148:36-69

12 Sacco RL,Adams R et al Guidelines for prevention of stroke in patients with ischemic stroke or TIA. A Statement for health professionals from the American Stroke Association on /stroke. Stroke 2006;37:577-617

13 Welsh Km. Review of the SPARCL trial and its subanalyses. Curr Atheroscler Rep. 2009 Jul;11(4):315-21.

14 Hatano S. Experience from a multicentre stroke register: a preliminary report Bull WHO 54,541-553.1976.

15 WHO STEPwise approach to stroke surveillance. WHO STEPS stroke manual 2006; Section 1:1-7

16 DÓlaberriague L, Litvan I, Mitsias P and Mansbach HH. A reappraisal of reliability and validity studies in stroke. Stroke 27, 2331- 2336.1996.

17 Jeffrey L Saver. Time is brain – Quantified. Stroke 2006;37:263-266.

18 Armin J.Grau.Christian Weimar,Florian Buggle et al. Risk factors, Outcome, and Treatment in subtypes of ischemic stroke.-Stroke 2001;32:2559-2566

19 Stephen Bagg, Alicia Paris et al Effect of age on functional outcomes after stroke rehabilitation. Stroke 2002;33:179

20 Vohra EA; Ahmed WU; Ali M. Aetiology and prognostic factors of patients admitted for stroke. J Pak Med Assoc 2000 Jul;50(7):234-6 (ISSN: 0030-9982)

21 Ong TZ: Raymond AA. Singapore Med J. 2002;43(10);517-21

22 Ross R. The pathogenesis of atherosclerosis: An update. New England Journal of Medicine 1988;20:488-500.

23 Prospective studies collaboration . Cholesterol, diastolic blood pressure, and stroke: 13,000 strokes in 450,000 people in 45 prospective cohorts. Lancet 1995:346:1647- 53

24 Atkins D, Psaty BM, Koepsell TD, Longstreth WT, Jr., Larson EB. Cholesterol reduction and the risk for stroke in men. A meta-analysis of randomized controlled trials. Ann Inter Med 1993;119: 136-45

25 Iso H, Jacob DR, Jr., Wentworth D, Neaton JD, Cohen JD. Serum Cholesterol levels and six-year mortality from stroke in 350,977 men screened for the multiple risk factor intervention trial. N Engl J Med 1989;320:904-10.

26 Wannamethee SG, Shaper AG, Ebrahim S. HDL cholesterol, total cholesterol, and the risk of stroke in middle-aged British men. Stroke 2000; 311:882-8.

27 Samy I Mcfarlane , Domenic A. Sica ;J Clin. Hypertens. 2005;7(5) 286-292.

28 Bonita.R, Scragg.R, Stewart A. Cigarette smoking and risk of premature stroke in men and women. British Medical Journal 1986;293: 6-8

29 Lefkovits J et al Acute stroke outcome: effects of stroke type and risk factors. Aust N Z J Med. 1992 Feb;22(1):30-5.

30 Wolf PA. Epidemiology of stroke.In:Mohr JP,Choi DW,Grotta JC et al (eds).Stroke:Pathophysiologydiiagnosis and management.4th ed Philadelphia Churchill Livingstone 2004,:13-34

31 Yano K,Reed DM, Maclean CJ. Serum Cholesterol and hemorrhagic stroke in the Honolulu Heart Program. Stroke 1989;20:1460-5

32 Dalal PM.Studies in young and elderly: Risk factors and strategies for stroke prevention. J.Assoc.Physicians India 197;45:125-31

33 Szczepanska-Szerej A, Wojczal J, Belniak E, Krasinska-Czerlunczakiewicz H, Stelmasiak Z. Does diabetes mellitus affect the course and prognosis of ischemic stroke? Neurol Neurochir Pol. 2003 Mar-Apr;37(2):327-37.

34 Arboix A; Rivas A et a.l Cerebral infarction in diabetes.Clinical pattern,stroke subtypes and predictors of in hospital mortality. BMC Neurol 2005; 5(1):9

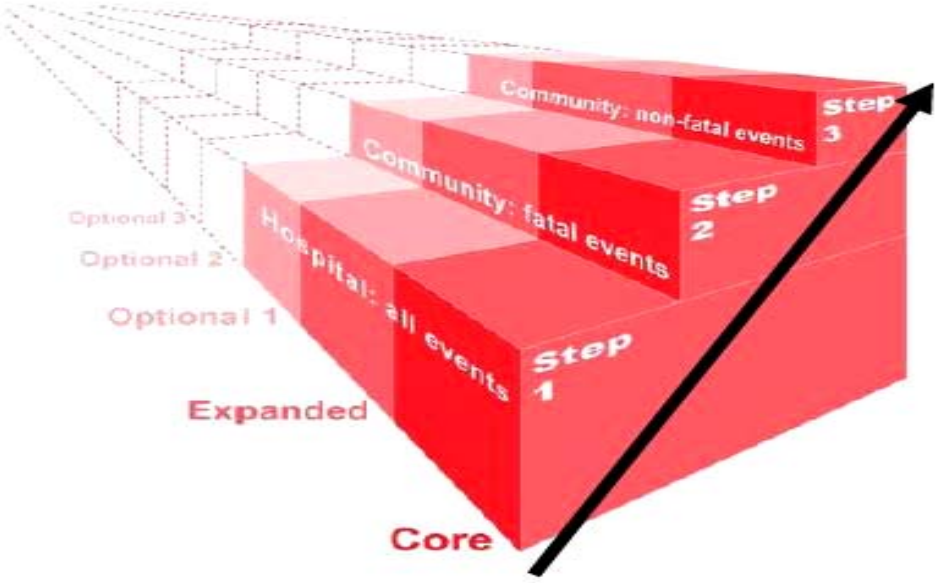
35 Catalina C. Ionita, Andrew R. Xavier, Adnan I.Qureshi,What proportion of stroke is not explained by classic risk factors. Prev. Cardiol. 2005;8(1):41-46.

36 Appelros P et al Poor outcome after first ever stroke: predictors of death, dependency and recurrent strokes within the first year. Stroke.2003;34(1):122-6

37 Johnston KC : Connors AF: A predictive risk model for outcomes of ischemic stroke. Stroke 2000;31(2):448-455

Annexures


STEPS
The WHO STEPwise approach to stroke surveillance


Community: non-fatal events
Step 3
Community: fatal events
Step 2
Optional 3
Optional 2
Optional 1
Hospital: all events
Step 1
Expanded
Core

NIH Stroke Scale

Item	Name	Response
1A	Level of consciousness	0 = Alert 1 = Not alert, but arousable easily 2 = Not alert, obtunded 3 = Unresponsive
1B	Questions	0 = Answers both correctly 1 = Answers one correctly 2 = Answers neither correctly
1C	Commands	0 = Performs both tasks correctly 1 = Performs one task correctly 2 = Performs neither task correctly
2	Gaze	0 = Normal 1 = Partial gaze palsy 2 = Total gaze palsy
3	Visual fields	0 = No visual loss 1 = Partial hemianopsia 2 = Complete hemianopsia 3 = Bilateral hemianopsia
4	Facial palsy	0 = Normal 1 = Minor Paralysis 2 = Partial paralysis 3 = Complete paralysis
5	Motot arm a. Left b. Right	0 = No drift 1 = Drift before 10 seconds 2 = Falls before 10 seconds 3 = No effort against gravity 4 = No movement
6	Motor leg a. Left b. Right	0 = No drift 1 = Drift before 5 seconds 2 = Falls before 5 seconds 3 = No effort against gravity 4 = No movement
7	Ataxia	0 = Absent 1 = One limb 2 = Two limbs
8	Sensory	0 = Normal 1 = Mild loss 2 = Severe loss
9	Language	0 = Normal 1 = Mild aphasia 2 = Severe aphasia 3 = Mute or global aphasia
10	Dysarthria	0 = Normal 1 = Mild 2 = Severe
11	Extinction / inattention	0 = Normal 1 = Mild 2 = Severe
	TOTAL NIHSS SCORE (00 to 42)	

Ref: Goldstein LB, Samsa GP; Stroke 1997;28:307-10

TOAST Classification

- Trial of Org 10172 in Acute Stroke Treatment
- Large Artery atherosclerosis
  - >1.5 cm
- Cardio-embolism
- Small vessel occlusion
  - <1.5 cm
- Stroke of other determined etiology
- Stroke of other undetermined etiology

- *Reference – Stroke 1993 Jan;24(1):35-41*

Modified Rankin Scale

0	**No symptom at all**
1	**No significant disability despite symptoms, able to carry out all usual activities**
2	**Slight disability, Unable to carry out all previous activities but able to look after own affairs without assistance**
3	**Moderate disability, requires some help but able to walk without assistance**
4	**Moderately severe disability, unable to walk without assistance and unable to attend ADL without assistance**
5	**Severe disability, bedridden, incontinent and requiring constant nursing care and attention**
6	**Death**

SAMPLE CASE SHEET

PROTEIN C & S elevated.

Protein C — 172
S — 150.

ICU-3

Lt PCA Infarct with Migraine.
DWI +ve, T2 +ve & FLAIR +ve.

I CASS III T_3 – 1.70↓ TSH – 1.210.
T_4 – 0.96

07

Patient's Name : Mrs. Anjana Nichani.

Stroke = 37

Serial No. :

Age : 40 yrs / Female.

Address 10, 14th Avenue, Harrington Road Chetpet chennai-31.

Ph. No: 28 36 33 46.

HISTORY

Date and Time of Attack : 11/10/08 at 6AM.

Admission Delay : 13 hrs.

20 0-3hrs ☑
21 3-6hrs ☐
22 6-9hrs ☐
23 9-12hrs ☐
24 12-24hrs ☑
25 24-48hrs ☐
26 48hrs to 7 Days (I CASS) ☐
27 More than 7 Days ☐

SYMPTOMS

	Yes = (x)	No = (y)		Yes = (x)	No = (y)
28 Headache	☑	☐	29 Nausea / Vomiting	☐	☑
30 Weakness Of Limbs	☐	☑	31 Numbness face / limbs	☐	☑
32 Mental Changes	☐	☑	33 Neck Pain	☐	☑
34 Dysphasia	☐	☑	35 Articulation Disturbed	☐	☑
36 Impaired Vision Rt homonymous hemianopia	☑	☐	37 Diplopia	☐	☑
38 Giddiness / Vertigo	☐	☑	39 Dysphagia	☐	☑
40 Imbalance of gait / Incoordination	☐	☑	41 Convulsions - focal / generalised	☐	☑
42 Retention of urine	☐	☑	43 Fever	☐	☑
44 Altered Consciousness	☐	☑	45 Others	☐	☑

SIGNS :

46 Weight	☐		47 Peripheral Pulses	☐	☐ (Abn.)
48 Carotid Bruit	☐	☐	49 Vertebral Bruit	☐	☐
50 Subclavian Bruit	☐	☐	51 Bruit over eyes	☐	☐
52 Lung Disease	☐	☐	53 Hepato Splenomegaly	☐	☐

08

60

GLASGOW COMA SCALE (GCS) :	1st Day	3rd Day	7th Day
Motor 6 - Obeys verbal commands 5 - Localizes to noxious stimuli 4 - Normal flexion to noxious stimuli 3 - Abnormal flexion to noxious stimuli (Decorticate posturing) 2 - Extension to noxious stimuli (Decerebrate posturing) 1 - No response to noxious stimuli			
M =			
Verbal 5 - Fully oriented and converses 4 - Disoriented and converses 3 - Voices inappropriate words 2 - Makes incomprehensible sounds 1 - No Vocalization			
V =			
Eye Opening 4 - Opens eyes spontaneously 3 - Opens eyes to verbal command 2 - Opens eyes to noxious stimuli 1 - No eye opening			
E =			
Total =	15/15	15/15	15/15

To obtain a GCS score add the points given from each of the three categories together. (Minimum score = 3, Maximum score = 15). The points given in each category should reflect the best response in a given time period. Note that a motor score can be as signed to both Left and Right sides. Use the greater motor score in the total GCS score. A modified and expanded GCS includes best / worst, and left / right motor scores.

On Admission

< 5 = A 5 - 10 = B 10 - 15 = C

1st Day ☐

3rd Day ☐

THE BARTHEL INDEX

STROKE UNIT - VHC / MNH

Name : _____ **Age** : _____ **IP / OP**

Address : _____ **Sex** : _____

Item	Name	Response	20/10	20/11	3/12			
1	Feeding	10 = Independent. Able to apply any necessary device. Feeds in reasonable time. 5 = Needs help, i.e., for cutting. 0 = Inferior performance.						
2	Bathing	5 = Performs without assistance. 0 = Inferior performance.						
3	Personal Toilet	5 = Washes face, combs hair, brushes teeth, shaves (manages plug if electric razor) 0 = Inferior performance						
4	Dressing	10 = Independent. Ties shoes, fastens fasteners, applies braces. 5 = Needs help but does at least half of task within reasonable time. 0 = Inferior performance.						
5	Bowel Control	10 = No accidents. Able to use enema or suppository if needed. 5 = Occasional accidents or needs help with enema or suppository. 0 = Inferior performance.						
6	Bladder Control	10 = No accidents. Able to care for collecting device if used. 5 = Occasional accidents or needs help with device. 0 = Inferior performance.						
7.	Toilet Transfers	10 = Independent with toilet or bedpan. Handles clothes, wipes, flushes, or cleans pan. 5 = Needs help for balance, handling clothes or toilet paper. 0 = Inferior performance.						
8	Chair / Bed Transfers	15 = Independent, including locks of wheelchair and lifting footrests. 10 = Minimum assistance or supervision 5 = Able to sit, but needs maximum assistance to transfer. 0 = Inferior performance.						
9	Ambulation	15 = Independent for 50 yards. May use assistive devices, except for rolling walker. 10 = With help for 50 yards. 5 = Independent with wheelchair for 50 yards, only if unable to walk. 0 = Inferior performance.						
10	Stair Climbing	10 = Independent. May use assistive devices. 5 = Needs help or supervision. 0 = Inferior performance.						
		TOTAL	100	100	100			

61 a) FINAL DIAGNOSIS

i) Anterior Circulation ☐ ii) Posterior Circulation ☑ Lt PCA

iii) Infarction ☑ iv) Hemorrhage (ICH, PVH) ☐ Infarct

61 b) CLINICAL DIAGNOSIS

i) Arterial

MCA — R - 1 ☐ / L - 2 ☐

ACA — R - 3 ☐ / L - 4 ☐

PCA — R - 5 ☐ / L - 6 ☑

BASILAR - 7

SCA — R - 8 ☐ / L - 9 ☐

AICA — R - 10 ☐ / L - 11 ☐

BRAIN STEM — 12-a R - ☐ / 12-b L - ☐ / 12-c Central

VERTERBRAL - PICA — R - 13 ☐ / L - 14 ☐

CEREBELLUM PURE — R - 15 ☐ / L - 16 ☐

ii) Venous - 17 ☐ iii) Tumors - 18 ☐ iv) Infections - 19 ☐

v) SDH - 20 ☐ vi) SAH - 21 ☐ vii) EDH - 22 ☐

62 ISCHEMIA

TOAST Classification (Trial of Org 10172 in Acute Stroke Treatment) subtypes of ischemic stroke

1. Large artery atherosclerosis ☑
2. Cardio embolism ☐
3. Small-vessel occlusion ☐
4. Stroke of other determined etiology ☐
5. Stroke of undetermined etiology ☐

63 OUT COME - on 28th day

(A) Discharged alive ☐ (C) Dead related to stroke ☐

(B) Discharged morbid ☐ (D) Death unrelated to stroke ☐

RISK FACTORS

64) Hypertension ☑ Yes (x) ☐ No (y) for 12 years

Mercury Sphygmomanometer

BP on admission RUL 110/80 mm Hg LUL

LUL	3rd day	1st week	2nd Week	4th week	2nd Month
	140/100 mm Hg				

64(a)

Family H/o HT ☑ Yes (x) ☐ No (y)

65) Diabetes Mellitus

(Ref __ WHO / NDC / NCS / 99.2)

Yes (x) ☐ No (y) ☑

	Venous Mg/dl	Capillary mg/dl	Plasma venous mg/dl
DM - fasting	> 110	> 110	> 126
DM 2 hrs PP	> 180	> 200	> 200
IGT - fasting	< 110	< 110	< 126
IGT 2 hrs PP	> 120	> 140	> 140
IFG - fasting	> 100	> 100	> 110

RBS – 72 mg/dl

66) Cardiac Diseases

66 (a) IHD

	Yes (x)	No (y)	
Clinical Features	☐	☐	
ECG	☑	☐	SR – 81/min WNL
ECHO	☑	☐	EF – 70%

66 (b) AF

Yes (x)	No (y)
☐	☑

66 (c) Valvular Heart Disease

	Yes (x)	No (y)
	☐	☑
- Prosthetic Valve	☐	☑
- Other Valvular Disases	☐	☑

66 (d) Congenital Heart Disease

Yes (x)	No (y)
☐	☑

ASD / VSD (etc)

67) Cholesterol

		x (mg/dl)	y (mg/dl)	
A	Total Cholestrol	< 200	> 200	187 mg/dl
B	HDL	< 40	> 40	48 mg/dl
C	LDL	< 160	> 160	116 mg/dl
D	TGL	< 150	> 150	116 mg/dl
E	VLDL	< 26	> 26	23 mg/dl

68) Tobacco

		Yes (x)	No (y)
H/o	Cigar / Cigrette / Beedi	☐	☑

69) Anemia

			Yes (x)	No (y)
Haemoglobin	< 10 mg / dl	(x) ☐	☐	☑
	> 10 mg / dl	(y) ☑	13.8 gms %	

70) Homocysteine

		Yes (x)	No (y)
	> 20 mg / dl (x) ☐	☐	☑
	< 20 mg / dl (y) ☐		

71) Alcohol

	Yes	No
1 Drink = 12 gm of Alcohol	☐	☑

72) Diet

	Yes	No
Vegetarian	☑	☐
Non - Vegetarian	☐	☐
Vegan	☐	☐